

Getting Ready for the  
2012 IMC

Presented by

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Agenda

- Ventilation
- Exhaust
- Ducts & Plenums
- ITM

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Enablers





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Existing





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Contents

1. Administration

2. Definitions

3. General Requirements

4. Ventilation

5. Exhaust Systems

6. Duct Systems

7. Combustion Air

8. Chimneys & Vents

9. Specific Appliances

10. Boilers & Water Heaters

11. Refrigeration

12. Hydronic Piping

13. Fuel Oil Piping

14 Solar Systems

15 Referenced Standards

Appendix

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Administration

Summary

- Scope
- Application
- Equivalency
- Enforcement

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Administration

Scope

Regulates the design, installation, alteration, maintenance, & inspection...

...permanent mechanical systems that control environmental conditions within buildings.

Exception: - Detached 1 & 2 family dwellings  
- Townhouses

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Administration



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Administration

Application

- Existing systems
- Maintenance
- Additions or alterations
- Change of occupancy
- Moved buildings

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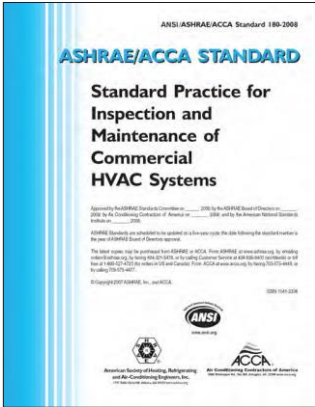
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ASHRAE 180

Purpose.

The purpose of this standard is to establish minimum HVAC inspection and maintenance requirements that preserve a system’s ability to achieve acceptable thermal comfort, energy efficiency, and indoor air quality in commercial buildings.

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**ASHRAE 180**

Scope.

New & existing buildings.

Standard does not apply to:

- Single-family houses or multi-family structures of three or fewer stories above grade.
- HVAC equipment and portions of building systems that primarily provide for industrial, manufacturing, or commercial processes.

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**ASHRAE 180**

Implementation.

Responsible Party.

- Building owner shall be responsible for meeting the requirements of this standard.
- Owner may designate other parties that shall be authorized and contractually obligated to fulfill the owner's responsibility.

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**ASHRAE 180**

Implementation.

Maintenance Program.

- Each HVAC system shall have a program that, at a minimum,
- Preserves the condition of the HVAC system and its elements in a manner that enables the system to provide the intended thermal comfort and energy efficiency and helps to achieve the intended indoor air quality required for the building.

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**ASHRAE 180**

Implementation.

Inventory of Items to be Inspected and Maintained

- Components of HVAC systems that impact the building’s performance shall be inventoried.
- This list shall be used to establish unacceptable system condition indicators, inspection frequencies and maintenance tasks.

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**ASHRAE 180**

Implementation.

Plan Development

- Shall describe each required task,
- Identify the party responsible for performing the task,
- Specify the authorizing party,
- Document its completion, and
- Subsequently monitor the results.

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**ASHRAE 180**

Implementation.

Plan Content

- Performance objectives
- Condition indicators
- Inspection & maintenance tasks
- Inspection & maintenance task frequencies
- Documentation
- Plan revision

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ASHRAE 180

TABLE 5-1 Air Distribution Systems

Inspection/Maintenance Task	Frequency*
Check control system and devices for evidence of improper operation. Repair, adjust or replace components to ensure proper operation.	Semi-annually
Visually inspect grilles, registers and diffusers for dirt accumulation. Clean as needed to remove dirt build up	Semi-annually
Lubricate field serviceable bearings.	Annually
Check for proper damper operation. Repair, replace or adjust as needed.	Annually
Visually inspect areas of moisture accumulation for biological growth. If present, clean or disinfect as needed.	Annually
Visually inspect exposed ductwork for insulation and vapor barrier integrity. Correct as needed.	Annually
Visually inspect internally lined ductwork until the first turn or up to 20 feet into the supply plenum from air handler for visible biological contamination and, if necessary, take corrective action.	Annually

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ASHRAE 180

TABLE 5-2 Air Handlers

Inspection/Maintenance Task	Frequency*
Check for particulate accumulation on filters. Clean or replace if accumulation results in pressure drop or airflow outside of established operating limits.	Monthly
Check air filter and housing integrity. Correct as needed.	Monthly
Check UV Lamp. Clean or replace as needed to ensure proper operation.	Quarterly
Check control system and devices for evidence of improper operation. Repair, adjust or replace components to ensure proper operation.	Semi-annually
Check P-trap. Prime as needed to ensure proper operation.	Semi-annually
Check fan belt tension. Check for belt wear and proper alignment. Replace if necessary to ensure proper operation.	Semi-annually
Check variable frequency drive for proper operation. Correct as needed.	Semi-annually
Check for proper operation of cooling or heating coil. Clean, restore or replace as required.	Semi-annually
Check control box for dirt, debris and/or loose terminations. Clean and tighten as needed.	Annually

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ASHRAE 180

TABLE 5-20 Rooftop Units

Inspection/Maintenance Task	Frequency*
Check for particulate accumulation on filters. Clean or replace if accumulation results in pressure drop or airflow outside of established operating limits.	Monthly
Check air filter and housing integrity. Correct as needed.	Monthly
Check UV Lamp. Clean or replace as needed to ensure proper operation.	Quarterly
Check steam system traps, pumps and controls. Clean or replace as needed to ensure proper operation.	Semi-annually
Check control system and devices for evidence of improper operation. Repair, adjust or replace components to ensure proper operation.	Semi-annually
Check P-trap. Prime as needed to ensure proper operation.	Semi-annually
Check fan belt tension. Check for belt wear and proper alignment. Replace if necessary to ensure proper operation.	Semi-annually

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Administration

Equivalency



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Referenced Codes & Standards



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Definitions

General  
General Definitions



101.2 Scope. This code shall regulate the design, installation, maintenance, *alteration* and inspection of mechanical systems that are...

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Definitions

ALTERATION. A change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.

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General Requirements

Summary

- General
- Protection of Structure
- Location of Equipment & Appliances
- Installation
- Temperature Control
- Smoke & Heat Vents

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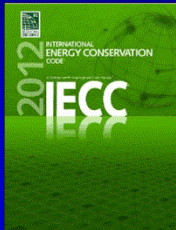
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General Requirements

General

HVAC design & installation



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IECC

Commercial & Residential

5 Chapters each

- Scope & Application
- Administration & Enforcement
- Definitions
- General Requirements
- Energy Effectiveness

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IECC

Intent

Regulate the design and construction of buildings for the effective use and conservation of energy over the useful life of each building.

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IECC

Governs

- Additions
- Alterations
- Changes of Occupancy or Use
  - (Increased demand for fossil fuel &/or electricity)
- Change in Space Conditioning

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IECC

Design Options

- ASHRAE 90.1
- Prescriptive (*Standard Design*)
- Performance (*Energy costs equal to or  $\leq$  85% of Prescriptive*)

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IECC

Commissioning

- Construction Documents
- Commissioning Plan
- RDP – evidence of successful commissioning

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General Requirements

Protection of Structure

Structural considerations



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General Requirements

Protection of Structure

Fire barrier penetrations



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General Requirements

Equipment & Appliance Location

- Prohibited in *hazardous locations*
- Fuel-fired appliances – prohibited locations
- Damage protection
- Outdoor installations
- Pits
- Prohibited in elevator shafts

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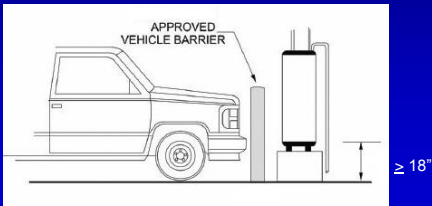
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General Requirements

Installation – Private Garages

Elevation of *ignition source* & damage protection



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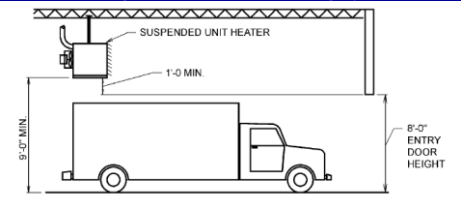
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General Requirements

Installation – Public Garage

Elevation of *ignition source* & damage protection



Source: Fig. 904.6(1) ICC 2012 IMC Commentary

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General Requirements

Installation

Boiler & Furnace Rooms



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General Requirements

Installation

Air-handling Equipment Rooms

Separation from shafts



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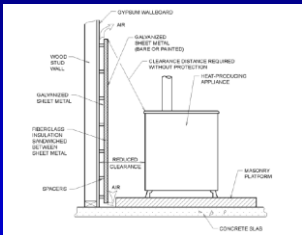
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General Requirements

Installation  
Clearances to combustibles & reduction methods

If not using a prescriptive method;

Compliance with UL 1618 *Wall & Floor Protectors, & Hearth Extensions* is required



Source: Fig. 508.3 ICC 2012 IMC Commentary

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General Requirements

Installation - *continued*  
Access for maintenance & replacement



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General Requirements

Installation - *continued*  
Equipment on roofs



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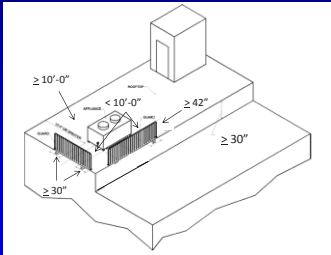
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General Requirements

Installation - Equipment on roofs



Source: Fig. 304.11 ICC 2012 IMC Commentary

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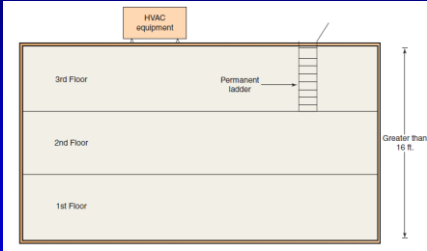
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General Requirements

Installation - Equipment on roofs



Source: ICC 2012 IMC Significant Changes

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General Requirements

Installation

Equipment /appliances having an ignition source are prohibited in Group "H"

if open use, handling or dispensing flammable or combustible liquids or explosive materials

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General Requirements

Smoke & Heat Vents



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Ventilation

Summary

- General
- Natural Ventilation
- Mechanical Ventilation
- Enclosed Parking Garages
- Uninhabited Spaces

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Ventilation

General

- Applies to occupied spaces within buildings
- Natural or mechanical
- Dwellings:
  - < 5 ACH @ 0.2" water column
  - Mechanical required



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Ventilation

General

Required when occupied

- Heating/cooling can cycle on/off
- Continuous ventilation blower
  - Rate can vary based on number of occupants

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Ventilation

General

Intake Openings - location *horizontally*

- $\geq 10'$  lot lines or same lot buildings
- $\geq 10'$  noxious contaminant sources
  - if  $< 10'$  then  $\geq 25'$  above
  - if  $< 10'$  then  $\leq 3'$  below source

*Assumes buoyancy*

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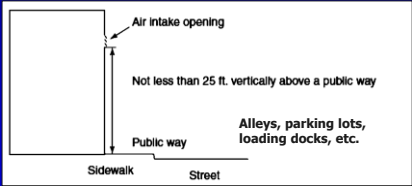
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Ventilation

General

Intake Openings  $< 10'$  horizontal



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Ventilation

General

Intake Openings - protection

- Exterior corrosion resistant screens or grills

Outdoor Opening Type	Min. & Max. Opening Sizes – louvers, Grilles, & Screens
Residential	¼" – ½"
Non-residential	> ¼" – 1"

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Ventilation

Natural

- Exterior openings (windows, doors, louvers, etc.)
- Opening controls accessible to occupants

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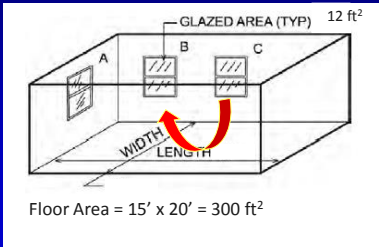
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Ventilation

Natural



Source: Figure 402.2 ICC 2012 IMC Commentary

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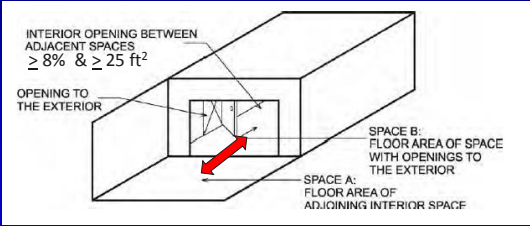
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Ventilation

Natural



Source: Figure 402.3 ICC 2012 IMC Commentary

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Ventilation

Natural



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Ventilation

Mechanical

- Consists of supply air and return or *exhaust air*
- Supply air  $\approx$  return or exhaust
- Positive or negative atmospheres permitted

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Ventilation

Mechanical

- Minimum outdoor airflow – Table 403.3
- Supplied to the *breathing zone*
- In the *occupiable space*

Exception: *RPD* demonstrates otherwise  
(Indoor Air Quality Procedure ASHRAE 62.1)

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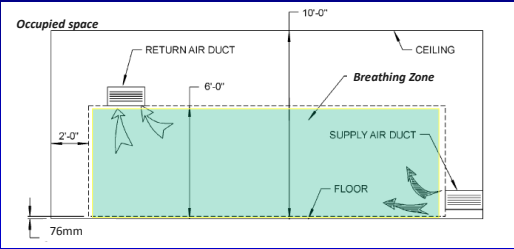
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Ventilation

Mechanical *(required rate of outdoor airflow)*



Source: Figure 403.3(1) ICC 2012 (IMC Commentary)

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Ventilation

Indoor Air Quality Procedure

analytical approach used to determine  
ventilation rates and air cleaning  
requirements

- Contaminant sources
  - *occupants & materials*
- Contaminant concentrations
  - *limits & exposure period*
- Perceived IAQ
  - *satisfaction levels*
- Minimum outdoor airflow rate



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Ventilation

Mechanical – Outdoor Air

Outdoor air cannot be recirculated

Exception: Excess outside air, *provided...*

- 1. No DU to DU or dissimilar occupancy
- 2. Pools to deck areas unless dehumidified
- 3. Smoking, nail salons, pet shops, etc.
- 4. Labs, locker rooms, etc. (10% max)
- 5. Energy Recovery Ventilation System limits

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Ventilation

Mechanical - Transfer

Recirculated outdoor air can be transferred and serve as makeup air for area exhaust in

- Kitchens, toilet rooms, baths, elevators, smoking lounges, etc.

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Ventilation

Mechanical – Outdoor Airflow Rates

- Rates per Table 403.3 & calculations
  - Assumed non-smoking
  - Smoking req's. more (*except smoking lounge*)
  - Table 403.3 OL can be reduced

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Ventilation

Mechanical – Outdoor Airflow Rates

Zone Outdoor Airflow

Calculations:

- Breathing zone outdoor airflow
- Zone air distribution effectiveness
- Zone outdoor airflow

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Ventilation

Mechanical – Outdoor Airflow Rates

Breathing Zone Outdoor Airflow

Equation 4-1:

$$V_{bz} = R_p P_z + R_a A_z$$

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Ventilation

Mechanical – Outdoor Airflow Rates

Breathing Zone Outdoor Airflow

Where:

- $A_z$  = Zone floor area (*Net occupiable area*)
- $P_z$  = Zone Population
- $R_p$  = People outdoor air rate
- $R_a$  = Area outdoor air rate

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Ventilation

Table 403.3

TABLE 403.3 - continued MINIMUM VENTILATION RATES				
Occupancy Classification	Occupant Density #/1,000 ft <sup>2</sup>	People Outdoor Airflow Rate in Breathing Zone R <sub>p</sub> CFM/person	Area Outdoor Airflow Rate in Breathing Zone R <sub>a</sub> CFM/ft <sup>2</sup>	Exhaust Airflow Rate CFM/ft <sup>2</sup>
Offices				
Conference rooms	50	20	0.06	0.6
Office spaces	5	5	0.06	0.06
Reception areas	30	10	0.06	0.06
Main entry lobbies	10	10	0.06	0.06
Specialty Shops	25	20	0.12	0.6
Nail salons <sup>h</sup>	25	20	0.12	0.6

<sup>h</sup> Source capture system at each nail station ≥ 50 cfm

Ventilation

Table 403.3 - continued MINIMUM VENTILATION RATES				
Occupancy Classification	Occupant Density #/1,000 ft <sup>2</sup>	People Outdoor Airflow Rate in Breathing Zone R <sub>p</sub> CFM/person	Area Outdoor Airflow Rate in Breathing Zone R <sub>a</sub> CFM/ft <sup>2</sup>	Exhaust Airflow Rate CFM/ft <sup>2</sup>
Offices				
Conference rooms	50	20	0.06	0.6
Office spaces	5	5	0.06	0.06
Reception areas	30	10	0.06	0.06
Main entry lobbies	10	10	0.06	0.06
Specialty Shops	25	20	0.12	0.6
Nail salons <sup>h</sup>	25	20	0.12	0.6

Ventilation

Mechanical – Outdoor Airflow Rates

Zone Air Distribution Effectiveness

Value of  $E_z$  per Table 403.3.1.2

Ventilation

Mechanical – Outdoor Airflow Rates

Table 403.3.1.2 Zone Air Distribution Effectiveness <sup>a, b, c, d, e</sup>	
Air Distribution Configuration	E <sub>z</sub>
Ceiling or floor supply of cool air	1.0 <sup>f</sup>
Ceiling or floor supply of warm air & floor return	1.0
Ceiling supply of warm air & ceiling return	0.8 <sup>g</sup>
Floor supply of warm & ceiling return	0.7
Makeup air drawn in on the opposite side of the room from the exhaust and/or return	0.8
Makeup air drawn in near to the exhaust and/or return location	0.5

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Ventilation

Mechanical – Outdoor Airflow Rates

Zone Outdoor Airflow

Equation 4-2:

$$V_{oz} = \frac{V_{bz}}{E_z}$$

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Ventilation

Mechanical – Outdoor Airflow Rates

System Outdoor Airflow

System Methods:

- Single zone [equation 4-3]
- 100-percent outdoor air [equation 4-4]
- Multiple zone recirculating

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Ventilation

Mechanical – Outdoor Airflow Rates

Submittals

- 106.3.1 Construction Documents
- Engineering calculations
  - Diagrams
  - Other data

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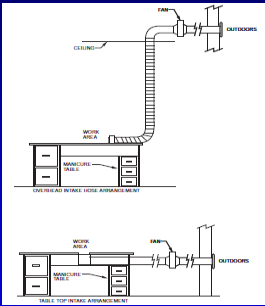
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Ventilation

footnote h.



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Ventilation

Open Parking Garage - criteria

- ≥ 20% of the wall area
- ≥ 40% perimeter or all on 2 sides
- Interior walls > 20% open



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Ventilation

Enclosed Parking Garages

- Intermittent operation
- Activation options:
  1. Detection of vehicle/people movement
  2. Carbon monoxide & nitrogen dioxide detection



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Ventilation

Enclosed Parking Garages

- Rate per Table 403.3 = 0.75 cfm per ft<sup>2</sup>
- Minimum allowable = 0.05 cfm per ft<sup>2</sup>

Occupied accessory areas

- Positive pressure
- Ventilation rate based on occupancy

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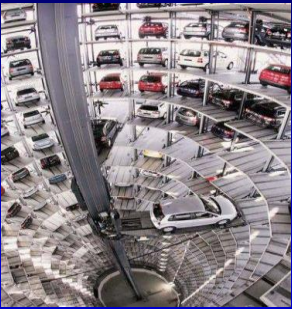
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Ventilation

NFPA 88A

Enclosed automated-type

- 2 ACH continuous



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Ventilation

Uninhabited Spaces

- Natural ventilation per Building Code; or
- Mechanical exhaust & supply
  - $\geq 0.02$  cfm per ft<sup>2</sup> &
  - Automatic control – relative humidity > 60%

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Ventilation

Healthcare Facilities – NFPA 99

System Category Criteria

- HCF governing body
- Function each space and system
- Category 1, 2, 3, or 4



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Ventilation

Healthcare Facilities – NFPA 99

Category Criteria – system failure

1. Death or major injury
2. Minor injury
3. Patient discomfort
4. No patient impact

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Ventilation

Healthcare Facilities – NFPA 99

ASHRAE 170 - *Ventilation of Healthcare Facilities*

ASHRAE - *HVAC Design Manual for Hospitals and Clinics*

FGI - *Guidelines for Design and Construction of Hospitals and Outpatient Facilities*

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Ventilation

Elevator & Dumbwaiter Hoistways

- > 3 Stories (*Exceptions*)
- Top of hoistway
  - direct to exterior, or
  - rated NC shaft
- Natural or mechanical



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Ventilation

Elevator & Dumbwaiter Hoistways

- SD actuated
- Vent area
  - Greater of  $\geq 3 \frac{1}{2}\%$  each car
  - or  $> 3 \text{ ft}^2$



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Ventilation

Commissioning

A systematic process that provides documented confirmation that building systems function according to the intended design criteria set forth in the project documents and satisfy the owner's operational needs, including compliance with applicable laws, regulations, codes, and standards.

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Ventilation

Commissioning

- ASHRAE Guideline 0 – *The Commissioning Process*
- ASHRAE Guideline 1.1 – *Technical Requirements for the Commissioning Process*

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Exhaust Systems

Summary

- General
- Specific Systems
  - Clothes dryers
  - Kitchens
  - Hazardous areas
  - Dusts
  - Energy Recovery

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Exhaust Systems

General

- Exterior discharge \*
  - Cannot be a nuisance
  - Located away from ventilation intakes
  - Not directed at walkways
  - Specific location of outlets

\* Exception: Whole house fans dedicated to ventilation or comfort cooling.

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Exhaust Systems

General

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Exhaust Systems

General

- General outlet locations:
  - Explosive or flammable vapors
  - Other dusts & wastes
  - Environmental air
  - Specific outlets

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Exhaust Systems

General

- Governs mechanical exhaust
- Systems must be independent

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Exhaust Systems

Clothes Dryer Exhaust

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Exhaust Systems

Commercial Clothes Dryer Exhaust

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Exhaust Systems

Domestic Kitchen Exhaust



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Exhaust Systems

Commercial Kitchen Ventilation/Exhaust



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Exhaust Systems

Commercial Kitchens - Hoods

- Type I or Type II  
Exceptions
  - Factory-built exhaust hood (UL 710)
  - Factory-built recirculating hood (UL 710B)
- Continuous operation during cooking  
Exception
  - listed multi- or variable speed exhaust

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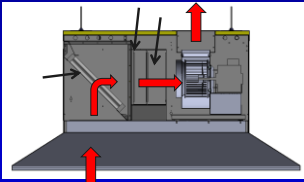
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### Exhaust Systems

Commercial Kitchens - Hoods

Factory-built recirculating hood (UL 710B)



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### Exhaust Systems

Commercial Kitchens - Hoods

Type I Hood

- Cooking producing grease or smoke
- Griddles, fryers, broilers, ovens, woks, etc.

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### Exhaust Systems

Commercial Kitchens - Hoods

Type II Hood

- Appliances producing products of combustion
- Cooking DOES NOT produce grease or smoke
- Dishwashers & appliances – heat or moisture

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### Exhaust Systems

Commercial Kitchens - Hoods

Type II Hood - Not Required

- If heat and moisture is produced , and
- HVAC exhaust rate 0.70 cfm ft<sup>2</sup>
  - 100 ft<sup>2</sup> per appliance, or
  - maximum floor area of kitchen

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### Exhaust Systems

Commercial Kitchens – Type I Hoods

Solid fuel source  
& Extra heavy  
duty cooking -  
independent  
exhaust required



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### Exhaust Systems

Commercial Kitchens – Hood Construction

- Steel or stainless steel
- Minimum thicknesses
- Noncombustible supports

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Exhaust Systems

Commercial Kitchens – Hood Construction

- Type I hoods
  - Continuous liquid tight welds
  - Liquid-tight penetrations
  - Design permits cleaning
  - $\geq 18"$  clearance to combustibles

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Exhaust Systems

Commercial Kitchens – Type I Hoods



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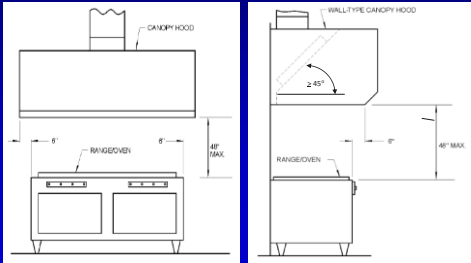
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Exhaust Systems

Commercial Kitchens – Type I Hoods



Source: Fig's 507.11.2(1)& (2) ICC 2012 IMC Commentary

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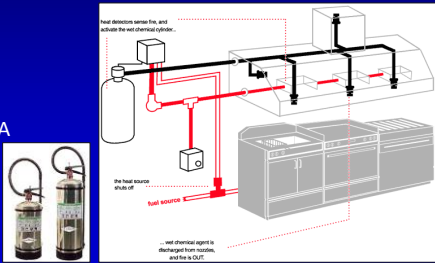
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Fire Suppression Systems

Commercial Kitchens – Type I Hoods

- NFPA 10
- NFPA 12
- NFPA 13
- NFPA 17
- NFPA 17A



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Exhaust Systems

Commercial Kitchens - Type 1 Ducts & Exhaust

- Independent of HVAC
- Manifold ducts
  - hoods in same room/area & same story
  - ducts do not penetrate fire barriers
  - cannot serve solid-fuel appliances

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Exhaust Systems

Commercial Kitchens - Type 1 Ducts & Exhaust

- Construction ≥ hood
    - Materials
    - Welded joints
    - Clearances
- Exceptions: list grease ducts (UL 1978)

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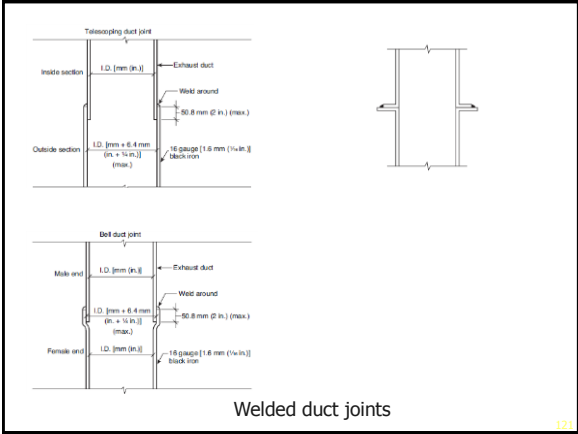
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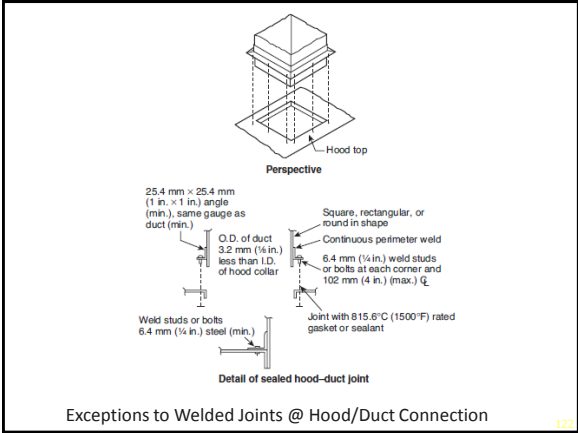
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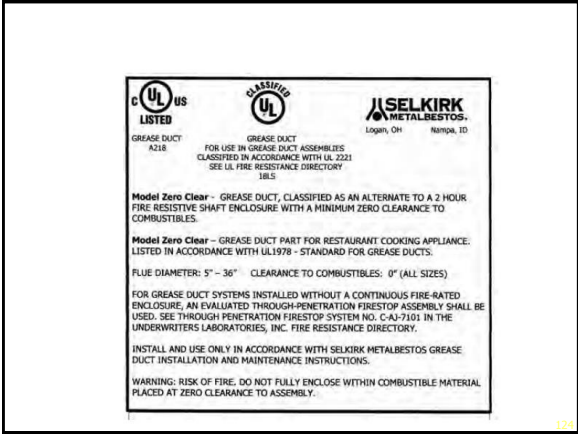
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**Exhaust Systems**

Commercial Kitchens - Type 1 Ducts & Exhaust

Preventing grease accumulation

NOTE: THIS CONSTRUCTION IS INTENDED TO PREVENT GREASE FROM ACCUMULATING IN THE DUCT.

3.05m Max.    6.1m Max.    Min. 305 mm x 305 mm  $\geq$  25.4 edge of duct

Horizontal run  $\leq$  22.9m,  $\geq$  2 % slope towards hood or reservoir

Horizontal run  $>$  22.9m,  $\geq$  8.3 % slope towards hood or reservoir

Source: Fig. 506.3.7 ICC 2012 IMC Commentary

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**Exhaust Systems**

Commercial Kitchens - Type 1 Ducts & Exhaust

Exterior wall termination

10' MIN. CLEARANCE TO COMBUSTIBLES

SEE SECTION 506.3.10.2

10' MIN. CLEARANCE TO COMBUSTIBLES

CONDENSIBLE OR NONCOMBUSTIBLE WALL

GRADE

Terminate  $\geq$  10'

- lot lines
- other buildings
- parts of same bldg.

Prohibited if

- Public Nuisance
- Fire Hazard
- Protected Openings

Source: Fig. 506.3.11 ICC 2012 IMC Commentary

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## Exhaust Systems

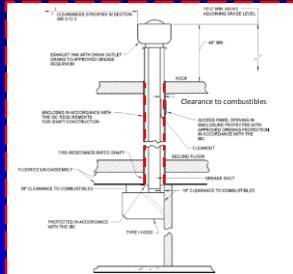
## Commercial Kitchens - Type 1 Ducts & Exhaust

## Roof-top termination

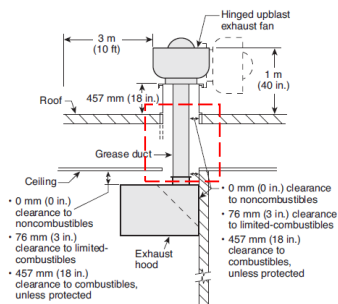
Shaft NR

- duct penetrates non-rated roof assembly

- field-applied grease duct enclosure (ASTM E 2336)



Source: Fig. 506.3.11.1(1) ICC 2012 IMC Commentary



Note: Enclosure is not required in 1-story building where roof ceiling assembly does not have a fire resistance rating.

**FIGURE A.4.2(d) Typical Section View for One-Story Building Without Fire-Rated Roof-Ceiling Assembly.**

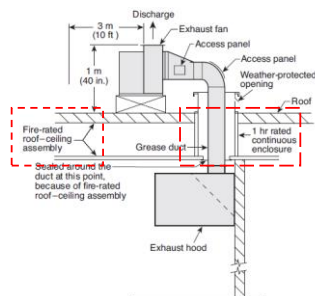


FIGURE A.4.2(b) Typical Section View for One-Story Building with Fire-Rated Roof-Ceiling Assembly. (Clearances given in Figure A.4.2(a) apply also to this drawing.)

Exhaust Systems

Commercial Kitchens - Type 1 Ducts & Exhaust

Roof-top termination



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Exhaust Systems

Commercial Kitchens - Makeup Air

- *Makeup air* = exhaust air
- Sources
  - Gravity
  - Mechanical
  - Both
- Intake location per 401.1

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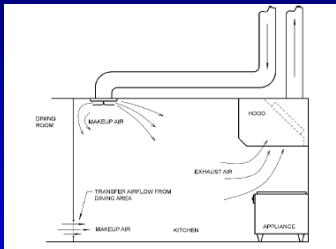
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Exhaust Systems

Commercial Kitchens - Makeup Air



Source: Fig. 508.1(1) ICC 2012 IMC Commentary

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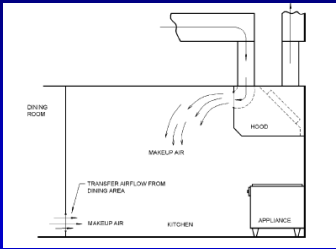
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Exhaust Systems

Commercial Kitchens - Makeup Air



Source: Fig. 508.1(2) ICC 2012 IMC Commentary

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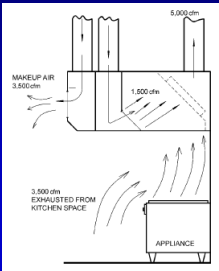
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Exhaust Systems

Commercial Kitchens - Makeup Air

Compensating hood

- Separate Label for
- Min. exhaust flow
  - Max. makeup air



Source: Fig. 508.1(4) ICC 2012 IMC Commentary

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Exhaust Systems

Commercial Kitchens - Makeup Air

- Mechanical makeup air
  - Supplied automatically
  - Continuous during exhaust mode
  - Tempered to  $\leq 10^{\circ}$  F  $\Delta$  of conditioned room air

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### Exhaust Systems

Hazardous Exhaust

- Capture & control hazardous emissions
  - Flammable vapors, fumes, mists, or dusts
  - Airborne toxicants or corrosives
  - NFPA 704 for classification of hazards

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### Exhaust Systems

Hazardous Exhaust

Flammability

Health

Instability



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### Exhaust Systems

Hazardous Exhaust - Required When

- Flammable vapor, gas, fume, mist, or dust
  - >25% concentration of LFL
- Vapor, gas, fume, mist, or dust
  - Health Rating = 4 (Any concentration)
  - Health Rating = 1, 2, or 3 (> 1% median lethal concentrations)

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Health Hazard

- 4 — Materials that, under emergency conditions, can be lethal
- 3 — Materials that, under emergency conditions, can cause serious or permanent injury
- 2 — Materials that, under emergency conditions, can cause temporary incapacitation or residual injury
- 1—Materials that, under emergency conditions, can cause significant irritation

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Exhaust Systems

Hazardous Exhaust - Woodworking

NFPA 91  
Vapors, gases, mists,  
& noncombustible  
particulate solids



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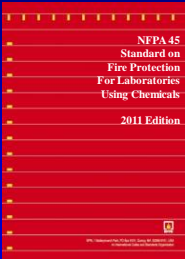
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Exhaust Systems

Hazardous Exhaust - Laboratories



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Duct Systems

Summary

- General
- Plenums
- Construction & Installation
- Insulation
- Smoke Detection & Control
- Duct & Transfer Openings

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Duct Systems

General

Governs all air movement duct systems

NFPA 82 *Standard on incinerators, Waste, and Linen Handling Systems and Equipment*



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Duct Systems

General - Air movement in egress elements

Prohibited

Exceptions

- w/in dwelling units
- Tenant spaces  $\leq 93m^2$
- Minor leakage from HC pressurized rooms
- Makeup air into some rooms from corridor



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Duct Systems

Plenums - Air movement

- Permitted
- Non-FRR corridor
  - FRR ceiling
  - SD shuts down AHU
  - AS shuts down AHU
  - Used for smoke control



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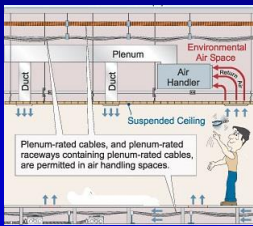
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Duct Systems

Plenums

- Limitations
- Fuel-fired equipment
  - ≤ 125°F if gyp. brd. used
  - Non-combustible or listed materials w/in
  - Plastic AS pipe if wet
  - Electrical
  - Insulation



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Duct Systems

Duct – Construction & Installation

- Materials
- Operating pressure docs.
  - Metallic ducts SMACNA HVAC Duct Construction Standard



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Duct Systems

Duct – Construction & Installation

Materials

- Non-metallic ducts UL 181
- Fibrous ducts SMACNA  
Fibrous Glass Duct  
Construction Standard
- Length unlimited



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Duct Systems

Duct – Construction & Installation

Flexible Connectors

- All UL 181
- ≤ 14' in length
- no wall, floor, or ceiling  
penetrations



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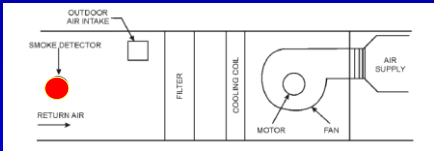
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Duct Systems

Smoke Detection & Control

- Returns of systems > 2,000 cfm
- Upstream of any filters, outdoor air or exhaust  
connectors



Source: Fig. 606.2.1 ICC 2012 IMC Commentary

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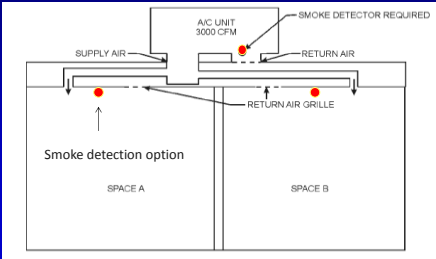
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Duct Systems

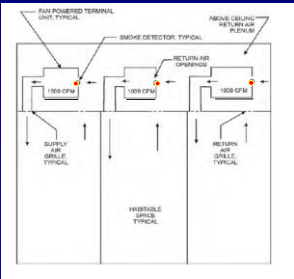
Smoke Detection & Control



Duct Systems

Smoke Detection & Control

Common Supply & Return Air Systems

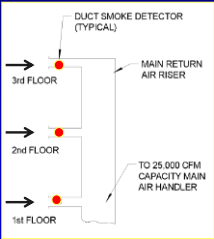


Duct Systems

Smoke Detection & Control

Return Air Risers

- > 15,000 cfm
- $\geq$  2 stories
- SD at each point of entry to the riser



Duct Systems

Duct & Transfer Openings

Fire Damper  
UL 555



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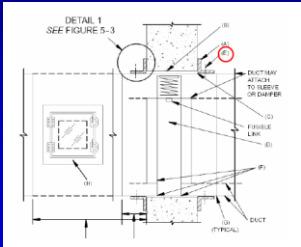
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Duct Systems

Duct & Transfer Openings

Fire Damper



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Duct Systems

Duct & Transfer Openings

Intumescent Caulk



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Duct Systems

Duct & Transfer Openings

Ceiling Fire Damper  
UL 555C



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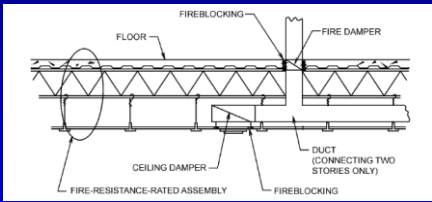
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Duct Systems

Duct & Transfer Openings

Ceiling Fire Damper



Source: Fig. 607.6.2(1) ICC 2012 IMC Commentary

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Duct Systems

Duct & Transfer Openings

Smoke Damper  
UL 555S



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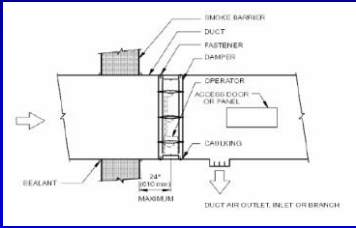
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Duct Systems

Duct & Transfer Openings

Smoke Damper



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Duct Systems

Duct & Transfer Openings

Combination Smoke  
& Fire Damper

UL 555 & UL 555S



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Duct Systems

Duct & Transfer Openings

Labeling



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Duct Systems

Duct & Transfer Openings

Fire Damper Ratings	
Fire Barrier Rating	Minimum Damper Rating (hours)
< 3 - Hour	1 ½
≥ 3 - Hour	3

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Duct Systems

Duct & Transfer Openings

Fire Dampers – Where required

- Fire walls
- Fire barrier walls
- Horizontal exits
- Corridor walls *smoke damper*
- Smoke barriers *smoke damper*
- Shaft enclosures

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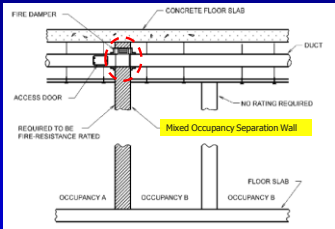
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Duct Systems

Duct & Transfer Openings

Fire Dampers – Fire Walls/Barriers



Source: Fig. 607.5 ICC 2012 IMC Commentary

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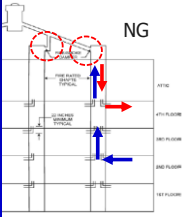
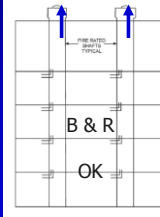
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### Duct Systems

Duct & Transfer Openings

Fire Dampers – Shafts



Source: Fig's. 607.5.2(1) & 607.5.5(2) ICC 2012 IMC Commentary

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### Duct Systems

Duct Penetrating Horizontal Assemblies

- FRR floors - shaft required  
Exceptions:
  - ≤ 2 stories – floor level FD's
  - ≤ 3 stories – w/in wall cavity of a DU
- Non-FRR floors
  - Shaft, or
  - ≤ 2 stories & annular space sealed
  - ≤ 3 stories & annular space sealed & fire damper

Source: Fig's. 607.5.2(1) & 607.5.5(2) ICC 2012 IMC Commentary

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### Duct Systems

Duct & Transfer Openings

Inspection, Testing, & Maintenance

- Visual inspection – post installation
- I & T – one year after installation
- I & T – every 4 years (HC = 6 years)
- Smoke & Comb. Smoke/fire per NFPA 105

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Duct Systems

- Duct & Transfer Openings
- Inspection, Testing, & Maintenance
- Documentation
- Damper location
  - Date & By whom
  - Deficiencies
  - Any corrective actions

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Evaluations

Questions

Goodbyes

Thank you

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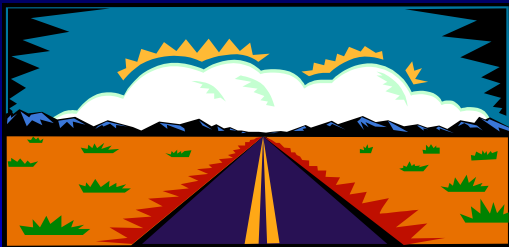
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Travel Safe

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